

APPARATUS FOR GYROSCOPICALLY-RESPONSIVE POWER ASSISTED VEHICLE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of and claims the benefit under 35 U.S.C. § 120 to U.S. patent application Ser. No. 16/126,606, entitled “GYROSCOPICALLY-RESPONSIVE POWER ASSISTED MOMENT ARM FOR LOAD CARRYING DEVICES,” filed Sep. 10, 2018, which is a continuation of and claims the benefit under 35 U.S.C. § 120 to U.S. patent application Ser. No. 15/017,273, entitled “GYROSCOPICALLY-RESPONSIVE POWER ASSISTED MOMENT ARM FOR LOAD CARRYING DEVICES INCLUDING PIVOTAL LOAD CARRYING DEVICES,” filed Feb. 5, 2016, now U.S. Pat. No. 10,093,337, issued Oct. 9, 2018, all of which are hereby incorporated by reference as if set forth in their respective entireties herein.

FIELD OF THE INVENTION

[0002] The present invention generally relates to apparatuses for providing a power assist to a vehicle. In particular, the invention relates to apparatuses that provide gyroscopically-responsive power-assist to vehicles such as load carrying devices that are operable via a moment arm. In further aspects, the invention relates to apparatuses for gyroscopically sensing the type of force applied to a moment arm and correspondingly driving a wheel in response to the type of force applied, independent of a tipping or carrying of a supported load.

BACKGROUND OF THE INVENTION

[0003] Load transport is a practice with origins dating back to ancient times. For example, wheelbarrows and similar apparatuses can reduce the effort a person must exert in order to transport a load. The addition of a motor capable of driving a wheel connected to the load transport can further reduce the effort needed. However, presently, such conventional motorized load transports are inefficient and unintuitive when interpreting the type of force applied at a moment arm of the load transport.

[0004] While a motorized transport can include a variety of sensors in order to determine the orientation of the wheel and provide power assist, such apparatuses, as known to the applicant, lack the ability to differentiate between a force meant to drive the wheel (e.g., a force in the direction of transport) and a force meant to unload the transport and not drive the wheel (e.g., a force to unload the transport, such as a rotational force).

[0005] Therefore, what is needed in the art is an apparatus that can extend the moment arm of a load transport to a pivot point, so that a gyroscopically-responsive power assist can be employed to differentiate between different applied forces and drive the apparatus accordingly. What is further needed in the art is such an apparatus that is further configured, in certain implementations, to only selectively provide power assist as a function of the differentiated applied forces, so that, for instance, a load can be tipped without causing the drive motor to be energized during that operation.

[0006] It is in regard to these issues that the present invention is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The accompanying drawing figures illustrate example embodiments and are not intended to be limiting of the invention. Among the drawing figures, like references are intended to refer to like or corresponding parts:

[0008] FIG. 1A illustrates an example moment arm extension apparatus in a stable state in accordance with at least one embodiment of the present invention;

[0009] FIG. 1B illustrates the example moment arm extension apparatus of FIG. 1A upon receiving a force in the desired direction of the apparatus's travel in accordance with at least one embodiment of the present invention;

[0010] FIG. 1C illustrates the example moment arm extension apparatus of FIGS. 1A and 1B upon receiving a rotational force in accordance with at least one embodiment of the present invention;

[0011] FIG. 2A illustrates a side view of an example application of a moment arm extension apparatus as applied to a wheelbarrow in accordance with at least one embodiment of the present invention;

[0012] FIG. 2B illustrates a top view of the embodiment of FIG. 2A;

[0013] FIG. 2C illustrates a side isometric view of the embodiment of FIG. 2A;

[0014] FIG. 2D illustrates a front view of the embodiment of FIG. 2A; and

[0015] FIG. 2E illustrates a bottom view of the embodiment of FIG. 2A.

SUMMARY OF THE INVENTION

[0016] Embodiments of the invention are directed towards providing a power assist to a user for carrying a load, and more specifically a moment arm is extended to a pivot point and a sensor can sense different types of forces to output signals to a motor which then drives a wheel.

[0017] In accordance with one aspect of the invention, an apparatus is provided for translating an applied longitudinal force to a rotational force for providing the power assist to a freely rotatable wheel. The apparatus according to this embodiment includes a moment arm component disposed along a longitudinal axis, having a proximal end and a distal end. A pivot point is disposed at the distal end of the moment arm component, such that at least a portion of the moment arm component is capable of free rotation about the pivot point around a first rotational axis. The apparatus further includes a single wheel, which is rotatably mounted about a second rotation axis, and is in connection with the pivot point. The single wheel can extend at least partially below a lower edge of the moment arm component. Additionally, the apparatus includes a motor connected to drive the wheel when energized.

[0018] Continuing with this aspect of the invention, the apparatus includes one or more sensors configured to sense a longitudinal force applied substantially along the longitudinal axis of the moment arm and configured to sense a rotational force applied about the pivot point. Finally, the apparatus includes a control system that is configured to output an energized signal for controlling power being provided to energize the motor. Such a control system activates or deactivates the motor using the energized signal by sensing at the one or more sensors whether a longitudinal force has been applied to the moment arm. Likewise, the control system accelerates or decelerates the wheel depend-